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greatest utility; an opinion in favour of which he adduces the authorities of Bouguer, Gobert, and Don George Juan. He then proceeds to calculate how far Mr. Seppings's braces are strong enough to sustain alone the force to which it has been proved that their situation is likely to expose them; and finds that they will support, without being crippled, such a change as may be expected when a seventy-four arches about two feet, but not more; and that they will afford a resistance fully sufficient to withstand a strain much greater than that which has been attributed to the pressure of the waves, and to the usual causes of arching. Dr. Young does not apprehend any evil from the omission of the internal planking between the parts, nor from the removal of the partial remedy which the immersion of the ends, produced by arching, affords to the unequal distribution of the weight and pressure. The filling-in between the timbers in the hold he considers as wholly unexceptionable; and remarks, that wedges may easily be driven in such a manner, while the ship is on the stocks, as to have a tendency to render the keel convex rather than concave below, and to prevent the common effect of arching when the ship is launched, without any other superiority of strength or workmanship; and that, without some such accidental cause, no ship when launched could be wholly free from a perceptible degree of arching. He doubts the superiority of Mr. Seppings's iron fastenings of the beams when acting as ties; and observes, that the obliquity of the planks of the decks diminishes in some degree the strength of the tie with respect to arching; but remarks, that it may perform a very important service in rendering the ship more capable of resisting the lateral strains, which, although sometimes very violent, have been little considered by theoretical reasoners: and he suggests that it may be possible to fix the carlings between the beams in such a manner as to contribute more materially to the strength in this respect. In case of the ship's grounding on a hard bottom, Dr. Young is disposed to think Mr. Seppings's construction somewhat weaker than the common one, on account of the omission of the ceiling; although an experiment made on the Tremendous proved that a force more gradually applied could be sustained without injury. And he concludes from the whole examination, that none of the objections which have been hitherto advanced appear to be sufficiently valid to warrant a discontinuance of the cautious and experimental introduction of Mr. Seppings's arrangements, which has been commenced by order of the Board of Admiralty.

Some further Observations on Atmospherical Refraction. By Stephen Groombridge, *Esq. F.R.S.* Read March 31, 1814. [*Phil. Trans.* 1814, *p.* 337.]

In the author's former communication to the Society on the subject of atmospheric refraction, he considered the observations of stars that were more than 80° from the zenith as not to be sufficiently depended upon for the determination of refraction in general; and

accordingly, in his computation of a formula for that purpose, η Ursæ Majoris, at 70° 10′ zenith distance, was the lowest star included in his estimate. By applying that formula to stars below 80° zenith distance, Mr. Groombridge has since found some correction to be necessary; for the refraction at the low altitudes is not really so great as might be presumed from that of stars less distant from the zenith. He has consequently been induced to make a course of observations on other circumpolar stars, beyond the former limits, and as near to his north horizon as the situation of his observatory would permit. Since the formula of Dr. Bradley appears most conveniently applicable to the purposes of the practical astronomer, but not quite correct in the numbers assumed for refraction at 45°, and for the coefficient of x, the author has endeavoured to find out such numbers as would correspond more accurately with observation, and has found that the same formula may be made to serve as low down as to 87° of zenith distance, by increasing the amount of the numbers before mentioned still a little more than he had formerly done.

But for stars of less altitude than this, or within three degrees of the horizon, he found that the same formula could not be made to serve throughout, but that it became necessary to vary the amount of the coefficient y nearly in proportion to the excess above 87° zenith distance.

The table of observations on which these estimates are founded is divided into two parts; the former of which is the result of more than 240 observations made upon sixteen stars between 80° and 87° zenith distance; and the latter is founded upon six other stars between 87° and 88° 42′ zenith distance.

The difference of the obliquities of the ecliptic, as deduced from the summer and winter solstices, or disagreement between the elevation of the equator, thence deduced, and the zenith distance of the pole, as inferred from the zenith distance of circumpolar stars, is ascribed by the author to error in the quantities of refraction, which was assumed too small by Dr. Bradley, And he remarks, that, on the contrary, his observations of the solstices, when reduced according to his own improved formula for refraction, agree in giving results that correspond with his observations of circumpolar stars.

With respect to thermometrical corrections, Mr. Groombridge observes, that his results appear to be most correct when reduced by the state of the thermometer without-doors instead of that which is within; and that the difference is very considerable where the zenith distances are so great as those included in the present remarks.